REMARKS

The foregoing amendments and these remarks are in response to the Office Action dated March 31, 2009. Applicants respectfully request a one month extension of time. Authorization is given to charge the appropriate fees to Deposit Account No. 50-0951.

At the time of the Office Action, claims 1-18, 20-22, 24, and 25 were pending in the application. In the Office Action, claims 1-18, 20-22, 24, and 25 were rejected under 35 U.S.C. §103(a). The rejections are discussed in more detail below.

I. Rejections based upon Art

Claims 1-18, 20-22, 24, and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,135,681 to Nuzzi et al. (hereafter "*Nuzzi*").

An amendment is presented to claim 1 herein to add an additional limitation, the disclosure of which is given in Fig. 5. While the term "curvature" is not mentioned explicitly in the disclosure, in paragraph [0017] last sentence it is disclosed that the sloping chip guide surface can be followed by a curved or a radius-provided chip break section. The term "radius" as used in paragraph [0017] obviously refers to a radius of curvature.

New claim 27 has also been added. This claim is based on previous claim 1, with an additional limitation. Disclosure for this claim can be found in present claims 3 and 4 regarding the terms "chip guide face" and "chip break section" as well as the "distance", and also in the specification paragraphs [0016], [0017] (for the sloping surfaces), as well as paragraphs [0047] to [0049] (paragraphs [042] to [044] of the application as filed). The limitation stating that the chip guide surface comprises a sloping surface with a constant tangent angle is based on language found in the description, in paragraph [0017]. A new figure 6 is added showing the chip guide surface with a constant tangle angle is also added, together with appropriate description in the specification.

The specific geometry of chip formers is explained based on Fig. 5 and certain sections of the specification as follows. In the embodiment of Fig. 5 it can be seen that the radius of curvature of the chip former 21 is relatively large (weak curvature) directly adjacent to the cutting edge 19 and decreases with increasing distance from the cutting edge (curvature gets stronger as the

distance increases). Applicant notes that the "radius of curvature" of a surface is the reciprocal of the "curvature" of that surface. In other words, the larger the radius of curvature, the weaker the curvature, or, strong curvature means small radius of curvature. More specifically, the curvature in the area of the chip guide face 26 extending from the cutting edge 19 towards the bottom of the chip former is smaller than in the area of the chip break section 27, which follows the chip guide face 26 and which commences at a distance from the cutting edge and extends to a boundary surface 17 of the corrugation 14, which is provided to remove the coolant-chip mixture during operation.

In an embodiment addressed in paragraph [0017] of the specification the chip guide surface 26 comprises a "sloping surface with a constant tangent angle", which sloping surface is followed by a curved chip breaking section. In this context, a sloping surface with a constant tangent angle corresponds to a flat (planar) surface having an infinite radius of curvature. With the radius of curvature being the reciprocal of the curvature of a surface, this may also be expressed such that the curvature of the chip former in the chip guide surface is smaller than the respective curvature in the chip breaking section. The fact that the chip guide face may have areas with uniform tangent angle virtually identical to the rake angle is also disclosed in paragraph [0013].

This type of geometry is definitely distinct from the geometry disclosed in *Nuzzi*. Figure 8 of *Nuzzi* seems to be the only concrete disclosure of the shape of the chip former in *Nuzzi*. Close inspection in Fig. 8 appears to reveal that the chip former of *Nuzzi* has a cross-section in the form of a circular arc. In a circular arc, i.e. in the arc of a circle, the radius of curvature is constant along the entire arc, and has a finite value. Therefore, there is a significant difference with respect to how the radius of curvature (or the curvature) of the surface of the chip former changes as the distance from the cutting edge increases. In the prior art of *Nuzzi*, the radius of curvature remains constant with increasing distance from the cutting edge, whereas in the presently claimed invention the curvature is relatively small close to the cutting edge and increases to relatively large values in the chip break section. Amended claim 1 and new independent claim 27 therefore reflect the described shape of the chip former in concrete terms to distinguish the claimed invention even further from *Nuzzi*.

It is believed that *Nuzzi* cannot provide any guidance towards to the teaching now claimed. Firstly, *Nuzzi* does not describe any details of the shape of the chip former. There is only written disclosure with regard to the positive rake angle. The only disclosure in Fig. 8 does not show or suggest the invention now claimed.

There is ample disclosure in the present specification regarding the advantages which may be obtained by the invention. Reference is made to paragraphs [0046] to [0049] of the specification (paragraphs [041] to [044] of the application as filed) and to Figs 4 and 5. It is described that the large, positive rake angle at the cutting edge 19 provides a small chip compression, which reduces the surface loading of the chip guide face 26 in this area, thereby reducing friction between the chip 22 and the chip guide face 26. If the radius of curvature of the chip former stayed constant starting from the cutting edge through the entire chip former, the chip would likely become very long since the chip would be pushed smoothly through the concave shape of the chip former. This is likely what would happen with a chip former having the shape of a circular arc, like in *Nuzzi*.

The technical effect is significantly different if the curvature of the chip former increases as claimed. In that case, the chip encounters increasingly stronger forces forcing the chip to bend and finally to break. As described in paragraph [0049] (paragraph [044] as filed) lines 7 *et seq.*, the precise breaking point of the chip is dependent on several factors, e.g. the deformability of the workpiece material, the drill machining rate, and the steepness of the chip break section 27. The distance between the chip break section (having the stronger curvature) and the cutting edge influences in the chip size, i.e. the length of the chip. Therefore, a desired chip size (length) can be set by varying the spacing (or the distance) between the cutting edge and the chip break section.

In other words, the present claims allow for a "planned chip shaping" with regard to the length of the chips. This very important particularly in drilling operations under minimum quantity lubrication conditions, as described in paragraph [0009], for example. If the chips are too long, they cannot be reliably carried away through the limited space within the corrugation. There will be a danger of clogging. On the other hand, extremely short chips can also not be reliably removed when using coolants with a low viscosity, because they do not offer an adequate resistance. Therefore, it is very desirable to have means to adjust the optimum size (length) of the chip for a particular process.

The prior art does not address this problem at all. This is particularly true for *Nuzzi*. The Office Action mentions in the sentence bridging pages 2 and 3, that "the U-shaped groove having a positive rake angle as shown by *Nuzzi* is provided in order to greatly facilitate chip formation and breakage". In this context the examiner refers to column 6, line 43. It is important to note that there is no mentioned of chip breakage in this section. Instead, it is disclosed in column 6, lines 40 *et seq.*:

> "The cutting geometry of the present invention also facilitates the formation of a positive rake 75 adjacent to the cutting edge 62 and 64 and to greatly facilitate chip formation from the location adjacent to the cutting edges."

Nuzzi only mentions chip formation, but there is no mentioning of chip breakage in the context of the groove. The only mention of chip breakage in *Nuzzi* is given in context with chip breakers 82 in column 6, lines 48 to 51, which read as follows:

> "Further, if desired, each of the surfaces 56 and 58 can be provided with chip breakers 82 to facilitate the reduction and size of and removal of chips created in the drilling process."

It is important to note that these chip breakers 82 have no influence whatsoever on the length of the chips. Instead, the chip breakers 82 are provided at spaced positions along the cutting edge (see e.g. Fig. 2), which means that the chip breakers are intended to reduce the width of the chips. This is not the problem addressed by the present application. The chip breakage according to the claimed invention is concerned with adjusting and appropriate length of chips generated at the cutting edge.

Therefore, at least for these reasons, the applicant is convinced that the prior art including *Nuzzi* cannot be used to reject the new claim based on an alleged obviousness.

For the foregoing reasons, independent claims 1, 15 and 27 are believed to relate to patentable subject matter, and to be in condition for allowance. The dependent claims are believed allowable because of their dependence upon an allowable base claim, and because of the further features recited.

II. Conclusion

Applicants have made every effort to present claims which distinguish over the prior art, and it is thus believed that all claims are in condition for allowance. Nevertheless, Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. In view of the foregoing remarks, Applicants respectfully request reconsideration and prompt allowance of the pending claims.

Respectfully submitted,

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